COMOPTEVFORINST 5000.1
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COMOPTEVFORINST 5000.1

Subj: USE OF MODELING AND SIMULATION (M&S) IN OPERATIONAL TESTING

Ref: (a) DoDINST 5000.XX (Draft)
(b) DoD Directive 5000.59, "DoD Modeling and Simulation Management," of 31 Jul 95
(c) COMOPTEVFORINST 3960.1G (OTD Manual)

Encl: (1) Glossary of Terms, Abbreviations, and Acronyms
(2) Sample Acceptance Criteria Matrix
(3) Sample Model Management Plan Outline
(4) Sample Memorandum of Agreement (MOA) for Validation and Verification (V&V) of Models and Simulations by Independent Agencies
(5) Representative Organizational Schematics for Simulation Management Boards (SMB) and Simulation Control Panels (SCP)
(6) End-to-End Accreditation Process Flowchart

1. PURPOSE. There is a general thrust to use more M&S and less live testing to save money and time in DoD acquisition programs. To date, models have been developed and maintained without the engineering discipline and documentation which would give the models credibility with acquisition oversight. This M&S instruction is intended to promulgate procedures which would make models useable by operational testers and lend credibility with oversight. Interim policy and guidance for the development and employment of credible models for use in operational testing are promulgated herein. When superordinate instructions are published this instruction will be modified as necessary.

a. There were several problems associated with the previous approach to model development and maintenance. Previously, credibility depended on verification, validation, and accreditation (VV&A). As previously practiced, VV&A was an end of the process check, costs were exorbitant, and results often did not meet the needs of the operational tester. This instruction promotes the philosophy that credible models will result if there is a disciplined model development and maintenance process. Quality must be built in and maintained. It cannot be verified and validated in at the end of the model development process. With dis-

cipline injected up front in the modeling process, the quest for savings from modeling can be realized. Reliance will be placed in the developers V&V process, as long as it is rigorous and documented, rather than IV&V as previously.

b. A standardized approach in the development of models and simulations will facilitate discipline and accreditation. In general, accreditation will depend on disciplined model development and disciplined model and simulation maintenance practices. To this end, operational test directors (OTD), operational test coordinators (OTC) and program managers (PM) across all warfare lines must be cognizant of model/simulation development requirements, schedules, evaluations, budgets and V&V requirements. This instruction serves to:

(1) Assist OTDs/OTCs and PMs in complying with M&S best practices, as well as incorporating and disseminating lessons learned from past use of models and simulations.

(2) Formulate a basis for model VV&A into the TEMP process.

(3) Standardize terminology as well as methodology of M&S VV&A.

(4) Comply with applicable provisions of the forthcoming DoD 5000.XX instruction (reference (a)) concerning the V&V of M&S within the DoD.

(5) Address the use of M&S in multiservice and joint testing, as well as in the joint training and joint M&S arena as defined by the Office of the Secretary of Defense.

2. CANCELLATION. None.

3. BACKGROUND. Complexity of systems currently fielded and those under development continues to increase. The result is a spiraling increase in costs and time to test. M&S of weapon system performance presents an attractive alternative to reduce costs and time to field. Additionally, models may help resolve issues which cannot be adequately resolved by live field testing. Typical limitations include range constraints, safety concerns, inability to test in all intended environments, and inability to accurately replicate the threat.

a. Models have long been used by the developer/developing agencies for such purposes as trade-off studies, risk analysis, test planning, subsystem and component level tests and design, test rehearsal and test analysis. If M&S is to play the same role in operational testing, models and simulations must be

credible with the tester and stand up to oversight. To this end, it is imperative that a rigorous and well documented procedure be in place to allow for and justify the use of modeled or simulated data to augment actual weapon system performance data.

b. The establishment of a defined methodology for model development facilitates the accreditation process and is in keeping with those policies advocated by the Office of the Secretary of Defense and the Secretary of the Navy. In addition, it is an integral component of the Assistant Secretary of the Navy (RD&A), Product Integrity Division, methods and metrics for product success. A disciplined model build process should result in considerable savings compared to the old methodology which relied on an end-of-process IV&V.

c. In general, for models being developed as part of an acquisition program, the PM controls development of the model and ultimately the amount of discipline built into the model. In order for the model products to be useful, the model must be developed by a disciplined process in which V&V are normal by-products. Accreditation and credibility could then rely on the documentation generated during development rather than an end-of-the-process V&V prior to accreditation.

d. The verification process checks to see that model implementation accurately represents the developer's descriptions and specifications. The subsequent validation applies the model to alternate data sets and attempts to determine the degree to which the model accurately reflects the real world. Based on the robustness of this process, the accreditation authority may then accredit the model for use in operational testing.

4. SCOPE. This instruction covers all models and simulations used to supplement operational testing. It includes pure mathematical simulations and computer/hardware-in-the-loop hybrid simulations. In all cases, devices, programs and methodologies of models determined by the OTD/OTC or COMOPTEVFOR to supplement or substitute for operational testing must meet the criteria established herein. This policy governs the use of legacy models and simulations currently in use, those under development, and those postulated for future use. Within this instruction the terms model and simulation are used interchangeably.

5. TERMS/ABBREVIATIONS/ACRONYMS. Modeling and simulation terminology used within this instruction and common to DoD are contained in enclosure (1).

6. OVERVIEW. As early as possible within the development process, COMOPTEVFOR will liaise with the PM to determine sufficiency of assets and resources for test. Upon determination that a need

exists to use models or simulations, steps should be taken to implement the procedures contained within this instruction. Early involvement, proper identification of requirements and close coordination with the program office are essential to the development of a functional model. Defined M&S requirements must be added to the test and evaluation master plan (TEMP) as soon as possible.

a. OTDs/OTCs must remember that the objective is to use the model to assess performance - not to focus on accreditation of the model as an end in itself. M&S is one of the tools used to define the effectiveness and suitability of a system and, as such, should be worked into the top level matrix of test and evaluation tools.

b. Model/simulation development resources must be identified as early as possible to enable the program to budget appropriately. Resources should reflect the financial and material requirements for accreditation as well as the technical expertise required to augment DoD personnel on the SCPs and SMBs where required and as described later.

7. RESPONSIBILITIES

a. Operational Testers. OTDs and OTCs must clearly define required model functionality early in the development cycle. Acceptability criteria shall be established by the responsible OPTEVFOR functional warfare division and briefed to COMOPTEVFOR as an integral component of the TEMP approval process. OTCs/OTDs shall coordinate with OPTEVFOR's M&S personnel to determine what is (1) feasible, (2) cost effective, and most importantly, (3) credible. It is imperative the acceptance criteria be determined with care. Up front involvement will enable the PM to accurately estimate the potential benefits of the model to reduce program cost, improve product quality, and project completion time. OTD/OTC input should include the anticipated range of data over which the model may be accredited for use, limitations that would render the model unacceptable for use, and conditions that would preclude model accreditation, etc. The acceptability criteria will be updated on a cycle corresponding to requirements updates (i.e., ORD/TEMP revisions, major milestones) or as needed on a case-by-case basis. Acceptability criteria shall be married to critical operational issues (COI) (resolution) and presented in matrix format to COMOPTEVFOR during routine instruction briefs. A sample format is contained in enclosure (2).

b. Program Manager's Participation. Analogous to the assets the PM provides for independent operational test, it is equally important that the PM support model development in a disciplined process. The establishment of the SMBs and the estab-

lishment and staffing of the SCPs together represent key PM's contributions to credible model development. The SMBs and SCP serve as a process internal to the developer as well as for the VV&A process. Specific recommendations are included in paragraphs 8b(1) and 8b(2) regarding SMBs, and in paragraph 8b(3) regarding SCPs. Also critical are the model management plan (MMP), rigorous configuration control, and V&V reports. These are discussed in par. 8a, Documentation.

8. REQUIREMENTS. Where shortfalls in operational testing resources occur, and models, simulations and/or federations of models are to be utilized to supplement operational testing in the field, two criteria must be met: (1) documentation, and (2) observation and review. The following discussions on documentation and observation and review refer to the model build process. Maintenance of model discipline is discussed in paragraph 8c.

a. Documentation. Documentation for models and simulations parallels the DoD best practices paradigm for a comprehensive approach to software development. The design, intended use, operating instructions, inherent limitations, etc., must be well understood and thoroughly defined to enable current and future use. Early program development of model documentation ensures that the build is a disciplined process. Additionally, the elements of VV&A should be living documents, current at any stage in the process.

(1) Documentation encompasses three key areas, each of which is subdivided into a number of key subelements. These elements are ultimately the basis for COMOPTEVFOR accreditation of a model or simulation. Deviations from the specifics are allowed to the degree that the essence of each requirement is conveyed. For example, quality assurance may not be specifically addressed in the MMP, but if the plan conveys the requisite level of oversight and checks and balances, the criteria is met. Legacy models which typically fail to meet the specific requirements are addressed later. The following types of documentation must exist:

- MMP
- version or configuration control
- validation report

(2) Model Management Plan. The MMP is the overarching M&S document and is singularly most responsible for ensuring that the model development is a controlled process. Instruction organization is the decision of the PM, model developer(s) and organization(s) responsible for write-up. The plan must identify the organizational roles, responsibilities, and interrelationships agents involved in developing, managing, and using the

model. It should document the procedures for development, implementation, changes, V&V, as well as specifying any independent V&V required. As such, OPTEVFOR early involvement is essential. The elements of a comprehensive MMP follows:

(a) A description and purpose of the model, specifically addressing:

- model use
- physical description
- constraints
- strengths
- limitations
- algorithm(s) description

(b) A summary of development background and usage (when/as applicable), specifically addressing:

- development history
- owners
- current users/customers

(c) Management approaches and plans for each of the following:

- projected schedule to completion
- design and coding
- quality assurance
- testing
- security
- documentation development
- planned upgrades
- personnel qualifications
- resource development

(d) Specific resources, to include:

- available documentation
- model points of contact
- data bases supporting the model
- technical expertise
- archival storage for model data

(e) Sample MMP. Enclosure (3) contains the outline of an MMP for a simple model currently in use. The program rep-

resents approximately 1250 lines of code. Obviously, more complex programs emulating more sophisticated systems require management plans commensurate with their complexity.

(f) Additional MMP Guidance. Models envisioned for use in augmenting operational testing must be planned for and integrated with live test planning from program onset. Last minute efforts undertaken due to incipient funding shortfalls or technology development delays are doomed to failure.

(g) The MMP should address a periodic and situational driven review of model development from managerial (SMB) and technical (SCP) perspectives. The implementation of both ensures that the model details are correct while still meeting the requirements of the "big picture." Careful selection and early involvement of team members will minimize the number of personnel, as at least some may be dual-hatted. The MMP should also include reviews coincident with scheduled early operational assessments (EOA) or operational assessments (OA).

(h) Lastly, the MMP should ensure that a disciplined change control process and review is in place to continue validation of the model or simulation as additional employment data from the weapon system is collected.

(3) Configuration Control. Configuration control is the meticulous tracking of hardware, documentation, program source, and object code from the initiation of a change, to include the change submittal and recommendation process through implementation, compilation, and distribution of the model program. It very closely resembles the configuration control process to be implemented for software-intensive systems. For purely software models it should be identical. The terms configuration control and version control are used interchangeably in this instruction. Version control may be defined in independent instruction(s) or may be embedded in the MMP. It identifies the plans and requirements that govern the configuration management. The version control or configuration management plan should address the following:

(a) Configuration control items, to include:

1. Hardware.

2. Program source and object code.

3. Program documentation of input variables, special variable requirements, default values.

4. Master list of all configuration items, their latest version numbers, and release dates.

5. Compatibility with other models/simulations necessary to accomplish program goals but not resident within the PM's organization.

(b) Definition of configuration control process to include:

1. Software status accounting procedures.

2. Handling of changes to requirements.

3. Translation of requirements changes to software.

4. Control points and reviews within the process.

(c) Changes to designs and coding.

(d) Testing of changes.

(e) Distribution control to include positive control.

(f) Description and results of all software control audits.

(g) Verification of correction of deficiencies.

(4) Verification and Validation. V&V are the foundation for accreditation. Solid management plans and configuration control are essential to ensuring a quality product, but V&V is the cornerstone. It cannot be overemphasized that early discipline in model development in terms of the documentation addressed earlier and periodic formal review addressed next obviate much of the end of process V&V. V&V procedures and the V&V agent's designation and responsibilities must be in accordance with the Navy Interim Policy Guidance on M&S VV&A, but as a minimum include:

(a) Accreditation Statement. If the model is to be used to supplement operational testing it will need to be accredited, and the acceptability criteria should be the opening paragraph(s).

(b) Operating parameters, to include:

1. Input parameter ranges.

2. Fixed data ranges.

3. Compatibility with live test data.

4. Sensitivity analysis of input variables.

5. Configuration to which these parameter and data ranges apply.

(c) Risk analysis of the model to include:

1. A comparison of the level of effort directed at the validation effort to the risk of a wrong answer for each specific model use.

2. Risks incurred in building the model.

3. Subsequent risks to the system under development.

(d) Summary of previous testing.

(e) Customer comments to date.

(f) List of trouble reports for the model.

(g) Code review to include review for correctness (any software packages employed and their results), consistency, and understandability.

(h) Algorithm review, to include assessment of adequate/nonexcessive fitting parameters.

(i) Input/output review.

(j) Data base review for consistency, currency, and correctness.

(k) Validation showing the data points selected with respect to the range for each variable or parameter. Testing should broadly cover the envelope and explore the boundaries or fringes. Testing in order of preference is:

1. Validation by comparison to actual system performance data ("real life").

2. Validation by comparison to similar pre-existing model results, in which there is high confidence.

3. Validation by code analysis or peer review.

(l) Analysis of test results from mean data to an explanation of model and simulation outliers.

(m) Comparative summary of model performance as specified in accreditation statement to demonstrated performance.

(n) Schedule of data capture during future events to provide further credibility to the model.

In the case where V&V are to be performed by an independent agency with oversight by the SCP and/or SMB, enclosure (4) contains the recommended baseline elements to be delineated in the MOA. The inclusion of all listed elements will ensure that the SMB has sufficient information to certify and the accreditation authority to accredit the model.

b. Observation and Review. M&S review is to be conducted on a regular basis. Frequency of review is ideally a function of the stage of model development and/or degree of use. Along with assessment on a regular basis, model development progress shall be evaluated at each phase of operational testing in accordance with the section on reporting requirements. Observation and review shall be conducted at both the managerial level (SMB) and the technical level (SCP).

(1) Simulation Management Board. The SMB is the principal agent for the development of simulation management policy and its implementation. Depending on the projected scope of the model or simulation (most likely to occur in the case of a federation of models), one or more SMBs may be required to support the overall effort. A sample SMB organization is depicted in enclosure (5). The title of the group is not important; their function, however, is critical. The SMB must be responsible as the PM's and user's agent for dealing with activities outside the program that are involved in model component development or integration. Ultimately, the SMB will be responsible for assessing model or simulation performance as an input to accreditation. In addition, the SMB will:

(a) Maintain program-wide oversight, provide recommendations, and take appropriate actions to ensure proper execution of simulation management objectives and policies as defined by the model users.

(b) Coordinate, resolve, and disseminate resolution of technical issues affecting authorized simulations.

(c) Serve as the user(s) designated representatives in discussions of model or simulation content and methodology for all program related models and simulations.

(d) Maintain the model/simulation archive and ensure retention of documentation provided in support of initial certification and any subsequent updates.

(2) To this end, the following actions on the part of the program office will facilitate implementation and operation of the SMB:

(a) Designate models and simulations requiring SMB certification as a prelude for accreditation early in the program.

(b) Ensure that statements of work, engineering change proposals, and/or tasking statements include the authority and responsibility for management, control, delivery, and maintenance of authorized models and simulations.

(c) Review and approve programmatic and technical recommendations of the SMB for consistency with assigned task priorities and available program resources.

(d) Approve the MMP.

(e) Coordinate the acceptance criteria with COMOPTEVFOR to ensure that the model will meet the required objectives to support operational test.

(f) Designate a single point of contact for coordination of all simulation management activities within the program.

(3) Simulation Control Panel. SCPs are responsible for providing technical support to the SMB and for reviewing and recommending simulation products for certification. Ideally, the SCP is a group of independent technical experts scrutinizing the operating details of the model or simulation in conjunction with internal program experts. The SCP should periodically review the model for accuracy of the approach, use of algorithms, applicability of data in use, software development (as applicable), hardware in use (as applicable), etc. SCP composition should reflect the major contracting agent, PM, COMOPTEVFOR, and an agreed upon number of technical experts working as trusted agents for COMOPTEVFOR. Issues regarding the model are to be forwarded to the SMB for review and resolution. Specifically, the SCPs are responsible for:

(a) Providing a recognized channel for technical review and technical approval of simulations and supporting documentation.

(b) Reviewing simulation products and processes. Recommend to the SMB, as appropriate, simulation certification with attached specific applicability of use for which the model or simulation is valid.

(c) Providing periodic model status, plans, schedules, and other reports as required to the SMB.

(d) The selection, review, and distribution of certified reference simulations, models, data bases and check cases as required.

(e) Maintenance of specific certification requirements for simulations within their purview.

A representative SCP is depicted in enclosure (5).

c. Maintenance of Model Discipline. Most of the legacy models and most of the developmental models which will be maintained over an extended period of time will reside with the Navy labs. This instruction proposes a "Partnership in Quality Models and Simulations" with key Navy labs as a means to maintain discipline in Navy models. In general, the requirements for maintaining models in credible condition are the establishment of model management boards and model technical panels and better documentation of model team activities. A study by Naval Air Warfare Center, China Lake, CA, indicates that the documentation required can be generated by adding one additional person to a model team. Enclosure(4) outlines an MOA which could be used as a basis for a "Partnership in Quality M&S" program.

9. ACCREDITATION PROCESS SYNOPSIS. A flowchart for the accreditation process summarizing the pertinent elements of this instruction is contained in enclosure (6).

10. REPORTING REQUIREMENTS. Evaluations during periodic review or EOA/OA's will be a quantitative and qualitative assessment of the management plan, version control, and the validation report. Grading criteria follows the standard COMOPTEVFOR reporting color codes (red, yellow, green, or white) where:

Red	There are areas of significant risk
Yellow	A moderate level of risk is identified
Green	Little or no risk is identified
White	Not evaluated or assessed

Equally important to reporting on the discipline in the process is a report on the model's capabilities. The report will include what information can be gleaned from the model and a comparison to the COI slated for resolution per the testing matrix defined earlier. For example, "The model predicts degraded performance against target type X in environment Y due to design limitation Z."

11. LEGACY MODELS VS NEW STARTS

a. It is obviously easier to inject discipline into the development process of a new start model or simulation to ensure that each of the criteria are met. It is much more difficult, however, to find an existing model that will perform in the manner desired while meeting the requirements for a model management plan, version control, and V&V. For a legacy model or simulation requiring one time usage, a peer review may be conducted for certification. The peer review will combine the essential elements and representative membership of normal SCPs and SMBs in an intensive review of the model. Operational testers, developer representatives, technical experts and academia will scrub the model in question and ascertain its applicability. This certification will then be the basis for accreditation by the operational tester. The certification shall not be renewed for additional testing, as this procedure will not be used as a substitute for formalized and substantive review on a regular basis.

b. In cases where additional future use of the uninstructioned, uncontrolled, or unvalidated model is considered, a formal management plan, version control strategy, and validation effort should be developed. Validation must always be considered for the case where model updates or enhancements are considered. Elements/members of the peer review may migrate to the formal SCP.

12. MULTISERVICE AND JOINT TESTING

a. In the case of multiservice or joint testing where the Navy is the lead service, M&S development for use in supporting operational testing will be in accordance with this instruction unless otherwise directed. Plans for model accreditation will be briefed to other services or DOT&E as appropriate at milestone decisions or as requested. Other service evaluation agency accreditation requirements will be incorporated to the extent feasible, after which the services may elect to augment with their own development efforts.

b. In the case where another service has development lead, a review of proposed model use and development will be conducted. If acceptable levels of model management, version control, vali-

dation, and levels of model performance are projected, COMOPTEVFOR may plan for their use in supplementing operational testing. COMOPTEVFOR may then accredit the model for its specific purpose. At any point COMOPTEVFOR may reject in whole or part aspects of the model deemed not to meet the criteria contained herein.

13. LESSONS LEARNED. OTDs/OTCs are directed and PMs are invited to submit M&S lessons learned after each phase of testing using the model or at other intervals deemed appropriate to the M&S branch at COMOPTEVFOR. The M&S branch will establish and maintain the lessons learned in a readily accessible format for review by other OTDs/OTCs and interested DoD parties.

14. FORMALIZATION OF PROCESS

a. To the maximum extent practicable, the model development plans should be incorporated in the TEMP process to assure that all interested parties are cognizant of applicable time lines, resources required, etc. It is recommended that the development time line and requirements be folded into TEMP Parts III, IV, and V to cover model work to date, current status, projected use, and resources required.

b. Reference (c) and this policy will be updated periodically to keep pace with changes to references (a) and (b).

c. OPTEVFOR, will publish an annual OT M&S requirements plan. This plan will involve quarterly planning conferences rotated through the various labs employed in the M&S process, and liaison with program managers. The reviews are to focus on works in progress, current practices, and future development programs for M&S requirements. In addition, OPTEVFOR will maintain an active M&S board reflecting the state of models under development or in use for OT.

15. SUMMARY. The application of a disciplined process from the early specification of acceptance criteria by OPTEVFOR, through meticulous documentation, to formal review and certification by the SMB will create a more reliable and certainly more credible process. Building discipline into a model during the model build process and then maintaining the discipline through the model's life will result in more useable, credible models and are key to realizing cost and schedule savings in development programs.

//S// J. J. Zerr
J. J. ZERR

Glossary of Terms, Abbreviations, and Acronyms

*** TERMS COMMON W/DRAFT DOD 5000.XX**

ACCEPTABILITY CRITERIA. A set of standards that a particular model or simulation must meet to be accredited for a specific purpose.

ACCREDITATION. The official certification by the operational tester that a model or simulation is acceptable for a specific purpose.

ACCREDITATION AUTHORITY. An individual occupying a position with the appropriate rank, grade, responsibility and/or authority to accredit a model, simulation, or federation of models and/or simulations for a specific purpose. For operational testing conducted by OPTEVFOR, this authority resides with Commander, OPTEVFOR.

CERTIFICATION. The determination that a data set has been verified and validated.

CERTIFICATION AUTHORITY. Individual or board with responsibility for certifying that a model has been properly verified and validated.

CONFIGURATION CONTROL. Same as Version Control.

COOPERATIVE DEVELOPMENT. A project in which two or more DoD components share in domain research, technical studies, or technology development that may result in dissimilar M&S applications.

DOCUMENTATION. Paper trail for model development designed to ensure mode development is a controlled, diciplined process.

FEDERATION (OF MODELS AND/OR SIMULATIONS). A system of interacting models and/or simulations, with supporting infrastructure, based on a common understanding of the objects portrayed in the system.

JOINT M&S. Abstract representations of joint and Service forces, capabilities, equipment, material, and services used in the joint environment by two, or more, military services.

JOINT TRAINING. Military based on joint doctrine to prepare joint forces for or joint staffs to respond to operational requirements deemed necessary by the commanders-in-chief to execute their assigned missions.

LEGACY MODEL. Model whose existence pre-dates the implementation of this instruction and typically fails to meet the documentation and observation and review criteria established herein.

MAJOR MODELING AND SIMULATIONS. Include, but are not limited to, M&S whose intended application will require accreditation by DoD or component policy; that will be elements of a federation of models and simulations; that are intended for reuse; whose application involves safety of life; and, whose development will involve commitment of significant DoD resources.

MODEL (OR SIMULATION). - A physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, or process.

MODEL MANAGEMENT PLAN (MMP). The overarching documentation governing the model, simulation or federation of model development, validation, verification, and use.

OBSERVATION REVIEW. Oversight of model/simulation development by the sponsor and users through technical and managerial panels.

SIMULATION CONTROL PANEL. Board of technical experts whose function is to provide technical support to the simulation management board on the operating details of the model.

SIMULATION MANAGEMENT BOARD. Executive board principally responsible for model management policy and its implementation.

VALIDATION. The processing of determining the degree to which a model is an accurate representation of the real world from the perspective of the model's intended usage.

VERIFICATION. The process of determining that a model implementation accurately represents the developer's conceptual description and specifications.

VERSION CONTROL. The concise and orderly dissemination and tracking of a model and any modifications to it. Used interchangeably with configuration control.

Sample Acceptance Criteria Matrix

SYSTEM DESCRIPTION: Missile with type XX seeker to counter type YY threat in type ZZ environment

End-to-end System Evaluation	Launch Effect	Acquis. Effect	Track Effect	Mid-Course Guid. Effect	Warhead Effect	ECCM & IRCM Effect
M&S Required for COI Resolution	NO	NO	NO	YES	NO	YES
Acceptance Criteria				Accurate represen-tation of seeker gimbal limits under designed g-loads w/in design op range. Model must include performance in temp range XX¨<T¨<YY¨, rain-fall AA"<R"<BB", etc to show guid-ance response under operational envi-ronments		Model to incl threat power out levels, (>XX watt/st) ducting and scintillation effects, threat modulation tech-niques

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Sample Model Management Plan Outline

The following is an example of an MMP for a relatively simple model. The model consists of approximately 1250 lines of code. The level of detail in any model management plan should be commensurate with its complexity. Italicized text below is the representative management input for this model. Details should accurately reflect the model under evaluation. Note that the criteria spelled out in part 8 of this instruction are tailored to the model under review.

1. Objectives. The objectives of the MMP are to:

a. *instruction procedures for applying management disciplines and system engineering (e.g. Configuration Management, quality evaluation, testing, security, etc.) throughout the life cycle.*

b. *identify the resources required to manage the model. (who, what, where, when, costs, etc.).*

c. *identify the organizational roles and interrelationships of all agencies involved in acquiring, managing and using the model while specifying the responsibilities of each.*

d. *instruction the level of independent V&V to be applied.*

e. other objectives as applicable.

2. Introduction. Address each of the following:

a. Purpose of the Plan. (*Example: This plan is being developed to instruct in the responsibilities and procedures supporting COMOPTEVFOR's use of the model to include the current evaluation effort, the configuration control process and procedures, and the process of obtaining and interpreting model results).*

b. Management Plan Updates and Control. *(Example: Updates to this plan will be approved by..., promulgated by..., distribution will be limited to...).*

c. Applicability. *(Example: This model management plan governs model(s) NAME, control NUMBER, VERSION XXX).*

3. Model Details

a. Objectives of the Simulation. *(Example: The simulation is designed to answer critical questions regarding COIs A, B, and C. Specifically, wrt system effectiveness, the model should provide information on the acquire, track, engage, etc).*

b. Operating Environments. *(Example: The model is designed to provide data on system performance in operating environments XX and YY. Insufficient (or no) system performance data exists in this area.)*

c. Identification of users, developing agencies, supporting agencies, and the relationships between them. *(Self-explanatory)*.

d. Identification of probable changes and planned improvements. *(Example: Program XX is designed as an evolutionary acquisition. The model/simulation will be updated during FOT&E to incorporate system performance with widget ZZ)*.

4. Software Development And Support

a. Identify roles, responsibilities and relationships of agencies involved in software development. *(Self-explanatory)*.

b. Identify all boards and committees involved in managing software resources. *(Self-explanatory)*.

c. Identify references and standards that apply. *(Example: Model development commenced under DoD 2167 standards, program is grandfathered under these standards until revision XX. Following waivers/additional restrictions have been implemented due to non-criticality/criticality of function YY...).*

d. Identify software development processes employed. *(Example: Integrating software employs full fault isolation and 5000-hour failure criteria during shakedown. Program employs XX subroutines. Subroutine AA employed commercial checking program MM to detect dead ends in the code, etc. Subroutine BB subcontracted to facility NN with unknown reliability.) Also include management controls used.*

e. Specify software development milestones. *(Example: Contractual, technical reviews and audits, test schedules, planned releases, and deliveries).*

f. Identify and describe all components of the software engineering environment.

g. Configuration Management. Identify the software status accounting procedures and policies, describe the configuration control process, and identify the results of previous audits and plans to correct deficiencies. *(See specifics required under configuration or version control and cross reference with industry best practices and COMOPTEVFOR OTD Manual, Software Annex)*.

5. Hardware Development And Support. *(Same as software)*.

6. Describe the plans and procedures for instruction preparation, update, control and distribution.

7. Identify the review and observation process. The process should have the functionality described in this instruction. Delineate board membership and positional responsibilities. *(Self-explanatory.)* Specify reporting requirements (Per this instruction). In the case of outside V&V efforts specify the agents, responsibilities, schedules, and supporting organizations.

8. Identify security requirements and responsibilities. *(Self-explanatory).*

9. Identify safety concerns and procedures. (Self-explanatory).

10. Develop a resource compendium. *(Example: The following resources are required by the specified dates in order to continue seamless model development:*

CPU-23X	*31 MAR 9X*
SENSITIVITY ALGORITHM	*27 JUN 9X*
3 AIDA PROGRAMMERS	*17 OCT 9X)*

11. Identify Training Requirements. *(Example: Maintenance technicians are required to demonstrate the following skills prior to repair or disassembly of mainframe components...., Personnel operating the system are required to complete...)*.

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Sample MOA for Validation and Verification of Models and Simulations by Independent Agencies

This outline is intended to form the basis of any MOAs executed between COMOPTEVFOR and technical agents for the purpose of evaluating or maintaining any model. Ultimately, the credible maintenance of models will allow for simpler reaccreditation. The MOA shall address the following essential elements:

Introduction
- Why procedure is integral part of OT
- Standardization of processes required for COMOPTEVFOR confidence
- This MOA defines scope and responsibilities

Management Interface
- Identify Management leads as designated by PM and COMOPTEVFOR
- Identify responsibilities
  - Designate Technical Leads
  - Specify conduct of early planning (as applicable)
  - Specify oversight of OT M&S efforts
  - Assist/Formulate SMBs, SCPs as required
  - Formulate technical interface
  - Specify designation of technical leads as designated by management leads
  - Delineate technical lead responsibilities
  - Coordinate TEMP M&S input
  - Execute and track M&S effort
  - Plan accreditation effort as required by COMOPTEVFOR
  - Plan network requirements for ADS applications

Simulation Management
- Specify critical review items (as listed in body of this instruction with additional elements as required).

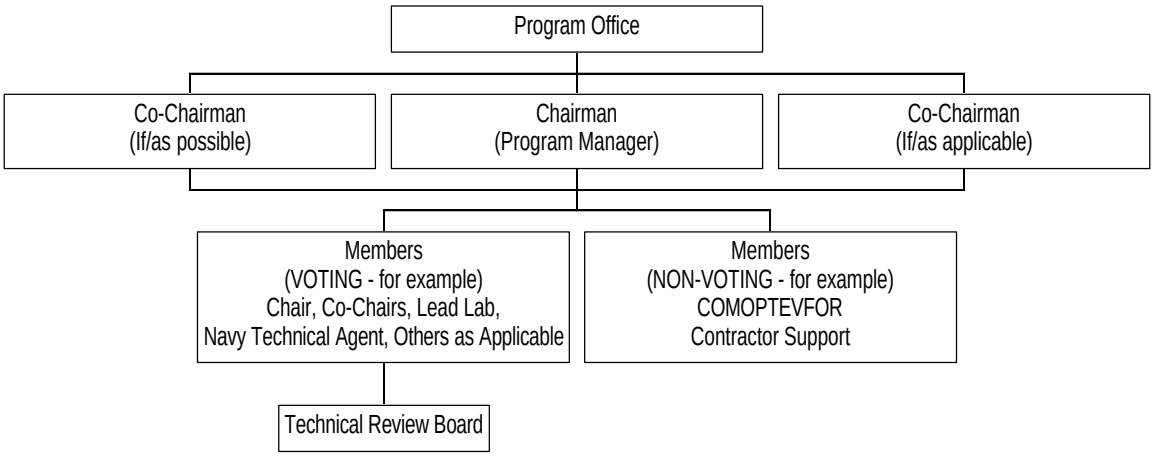
Evaluation of Simulation Management Plan
- Specification of report format

Configuration Management
- Specify critical review items (as listed in body of this instruction with additional elements as required).
- Evaluation of Configuration Management
- Specify report format

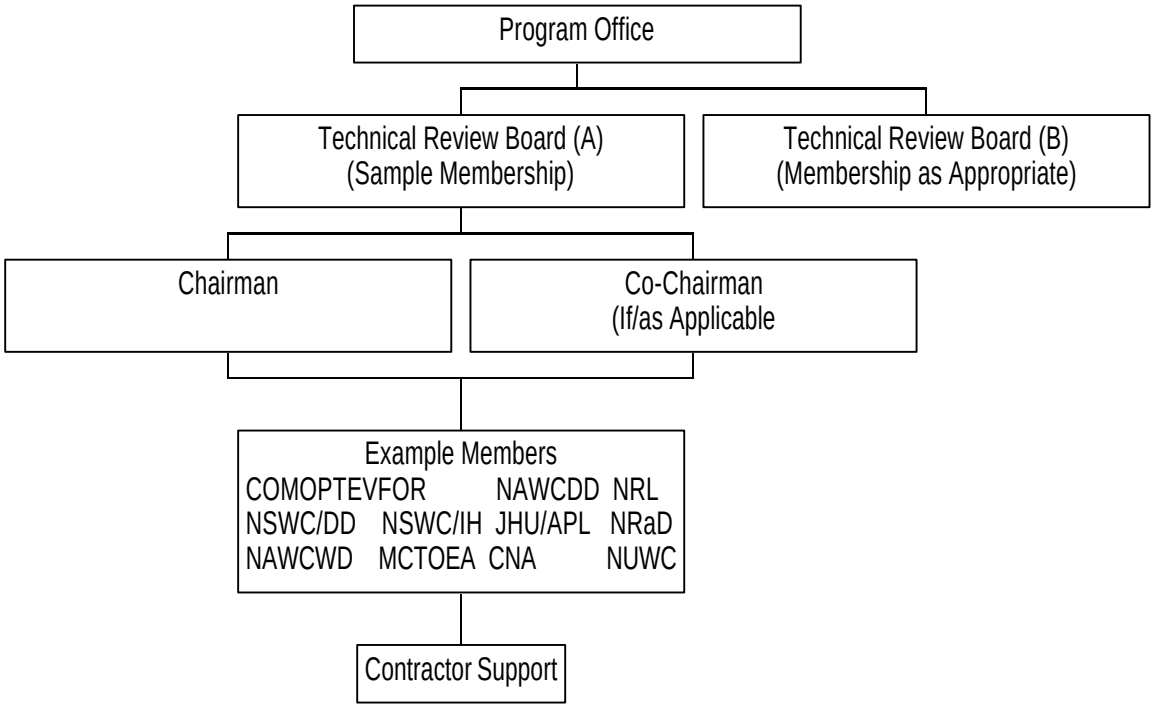
Verification and Validation
- Verification and validation methods requirements *(Recommend the following be included: detailed description of methods employed, audits conducted, comparisons made, test*

data used, other simulations employed, identification of subject matter experts with credentials and opinions).

Sample Organization
for
Simulation Management Board (SMB)



Technical Review Boards (TRB)



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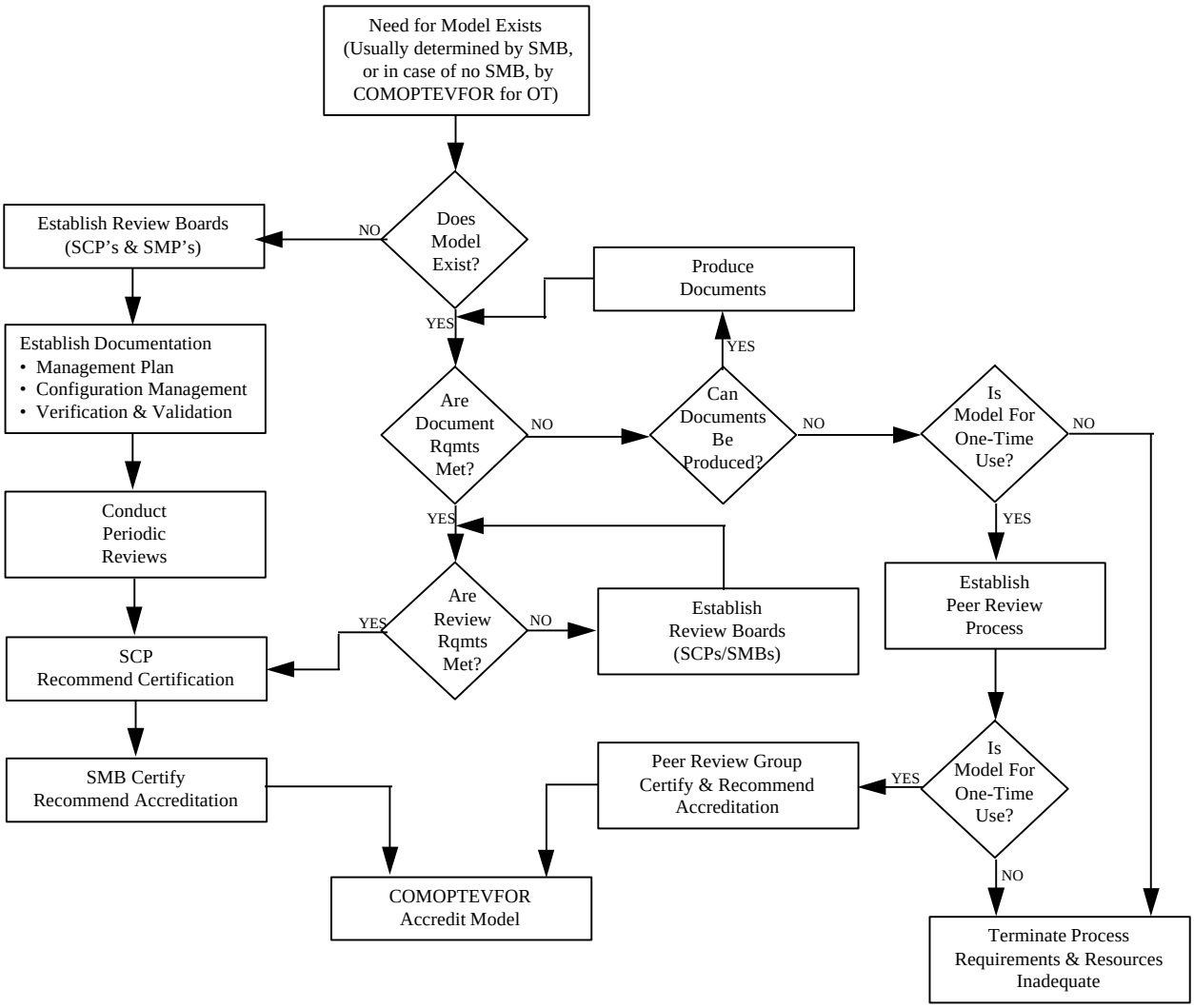
Accreditation Process Flowchart



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